

You will need to obtain the signature of your instructor or TA on the following items in order to receive credit for your lab assignment. Signatures are due by **Friday, September 29, 2023 (Part 1 Elements)** and **Friday, October 6, 2023 (Part 2 Elements)**.

Print your name below, sign the honor code pledge, and then demonstrate your working hardware & firmware in order to obtain the necessary signatures.

Student Name: SHRUTHI THALLAPALLY

**Honor Code Pledge:** "On my honor, as a University of Colorado student, I have neither given nor received unauthorized assistance on this work. I have clearly acknowledged work that is not my own."

Student Signature: T. Shruthi

### Signoff Checklist

#### Part 1 Required Elements

- ☒ Schematic of acceptable quality, correct memory map, SPLD .PLD file
- ☒ Pins and signals labeled, decoupling capacitors, and two 28-pin wire wrap sockets present on board
- ☒ NVRAM (as EPROM substitute), decode logic, and LED functional
- ☒ Understands device programmer.
- ☒ Demonstrated ability to use logic analyzer to capture bus cycles and view fetches from NVRAM. Shows detailed knowledge of both state and timing modes. Captures latched address lines A[15:0], data lines D[7:0], ALE, /PSEN, and NVRAM chip select signal on the logic analyzer display.
- ☒ Shows and discusses logic analyzer screen captures:
- ☒ Assembly program and timer ISR functional:

TA signature and date

#### Part 2 Required and Supplemental Elements

- ☒ AT89C51RC2, RS-232, and FLIP functional
- ☒ 74LS374 debug port functional
- ☒ Understands timing analysis, setup/hold/propagation
- ☒ ARM code build process, LED program, version control

Instructor/TA Comments: ☐ ☐ ☐

TA signature and date

### FOR INSTRUCTOR USE ONLY

#### Part 1 Elements

	Not Applicable	Poor/Not Complete	Meets Requirements	Exceeds Requirements	Outstanding
Schematics, SPLD code	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Hardware physical implementation	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Part 1 Required Elements functionality	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Sign-off done without excessive retries	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Student understanding and skills	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Overall Demo Quality (Part 1 Elements)	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

### FOR INSTRUCTOR USE ONLY

#### Part 2 Elements

	Not Applicable	Poor/Not Complete	Meets Requirements	Exceeds Requirements	Outstanding
Schematics, SPLD code	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Hardware physical implementation	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Part 2 Required Elements functionality	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Supplemental Elements functionality	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Sign-off done without excessive retries	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Student understanding and skills	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Overall Demo Quality (Part 2 Elements)	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

**NOTE:** This signoff sheet should be the top/first sheet of your submission.

[+] Schematic is clean and correct. SPLD correct too.

[+] Functionality of the interfacing is correct.

Q/A [-] Timer can not make LED blink at correct frequency.

[+] Correct use of the logic Analyser, but needs more practise with stake mode.

[+] Handaxe assembling very good.

[-] NVRAM too cap missing.

## Part 2

(+) good Schematics

(+) Flip functional.

(+) ARM part c functional, part B not done.  
part B complete. **B**

### SUBMISSION QUESTIONS:

- a) What operating system (including revision) did you use for your 8051-code development?

**Ans:** Windows OS

- b) What assembler(s) (including revision) did you use?

**Ans:** Keil uVision 5

- c) What ARM development tools did you use?

**Ans:** STM Cube IDE

- d) Did you install and use any other software tools to complete your lab assignment?

**Ans:** I have used the above software and LogicPort to complete these lab assignments.

- e) Did you experience any problems or challenges with this lab assignment or any of the software tools? If so, describe the issues.

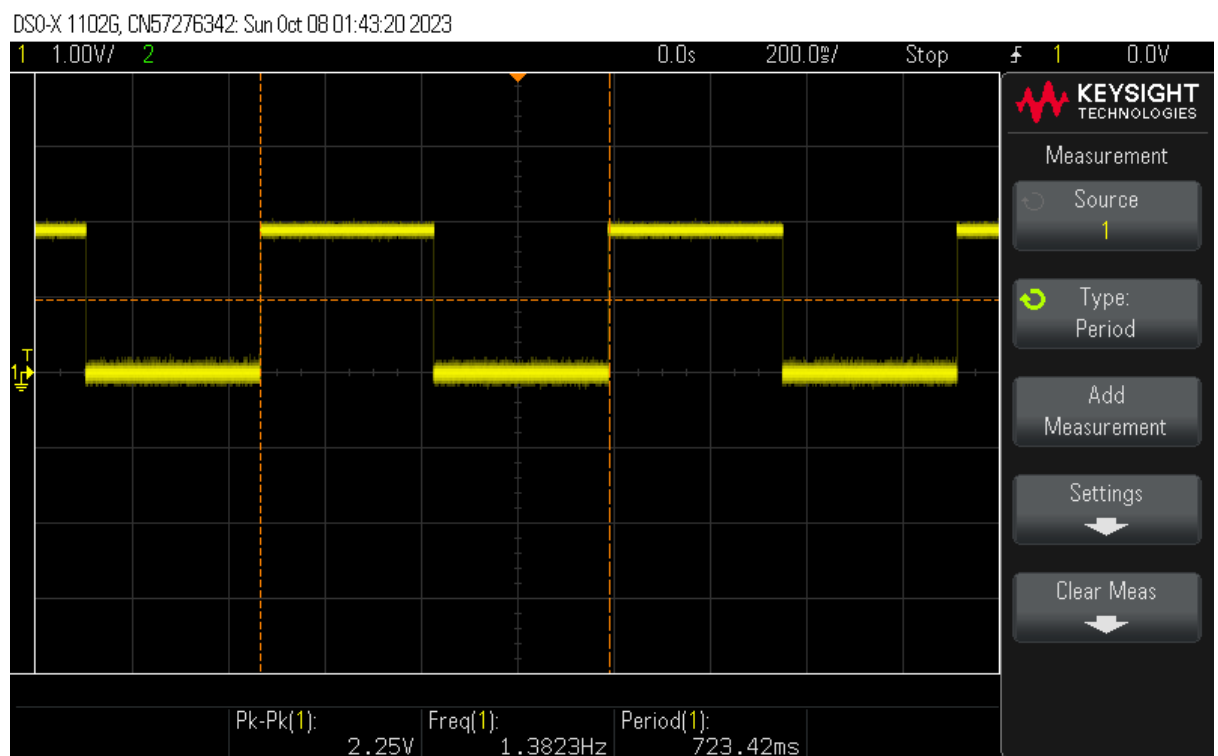
**Ans:** I found some difficulty in the beginning in using a new software/IDE and working in it.

- f) If you have any suggestions for changes to this lab assignment for the future, please include those ideas in your submission.

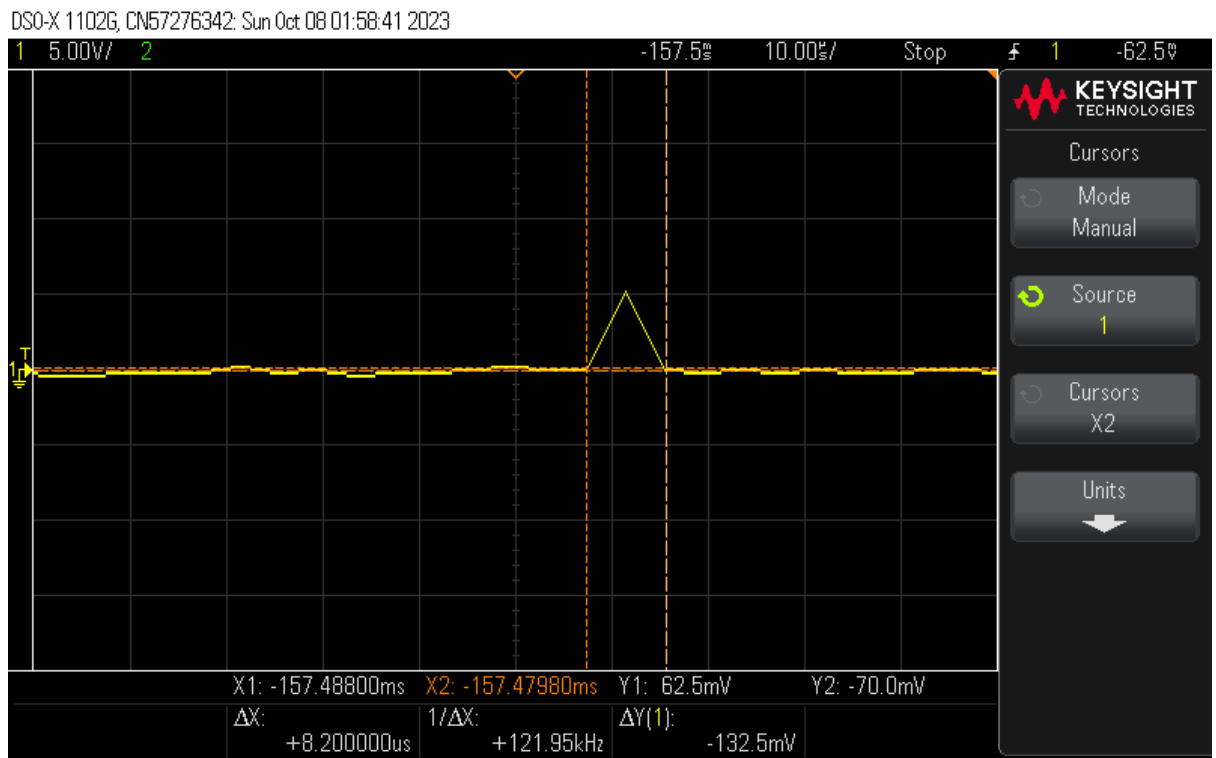
**Ans:** It would be helpful if demo sessions are conducted when new software is required to be installed/used. It would be helpful if more clarity is given on the things that is expected from us.

### TIMING DIAGRAMS:

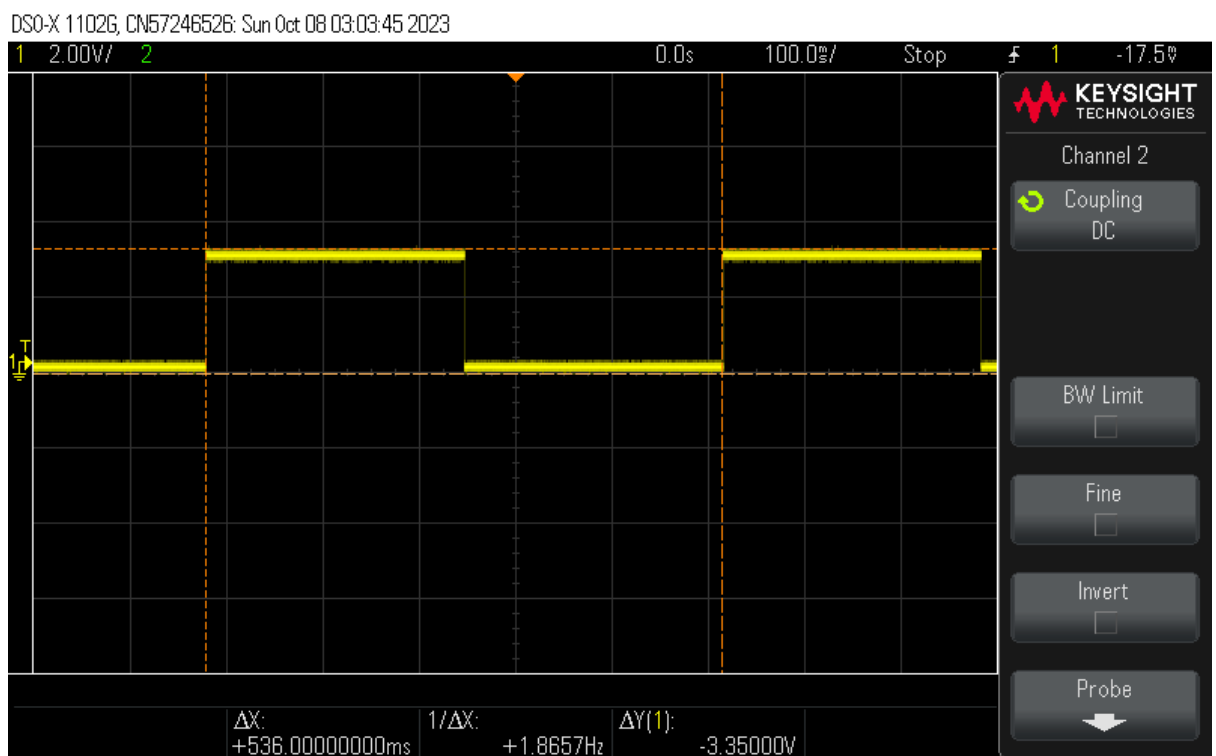
1. Oscilloscope screenshot of Part 1 Toggling LED with the frequency of 1.38 Hz.



- Oscilloscope screenshot of Part 1: Toggling another unused pin when entering and exiting ISR.



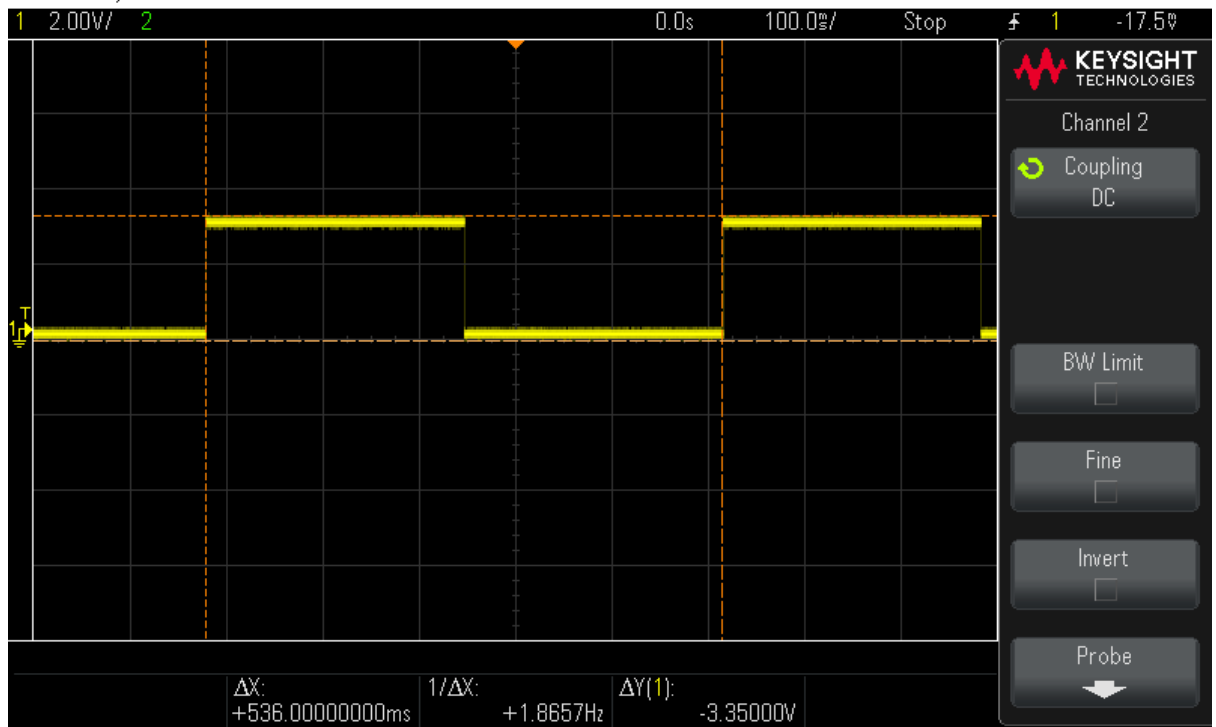
- Oscilloscope screenshot of Part 2: Toggling LED using STMCube IDE





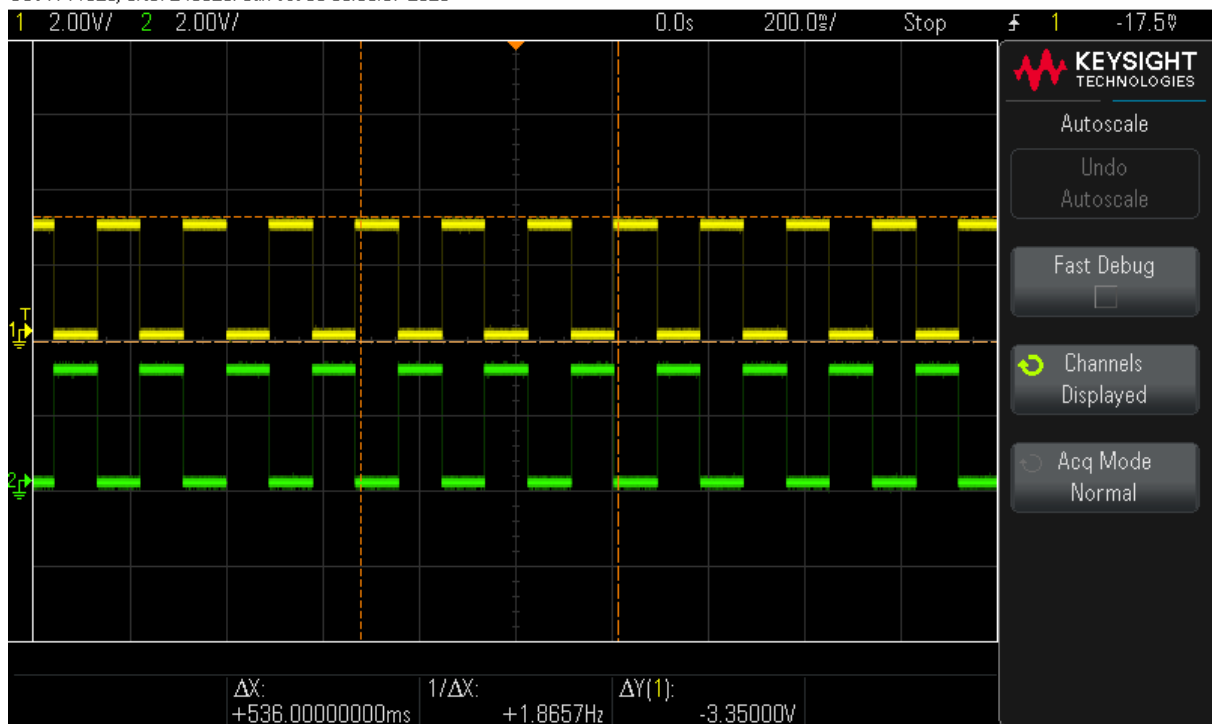
4. Oscilloscope screenshot of Part 2: Turning on the on-board LED for 270ms and turning it off for 270ms.

DSO-X 1102G, CN57246526: Sun Oct 08 03:03:45 2023

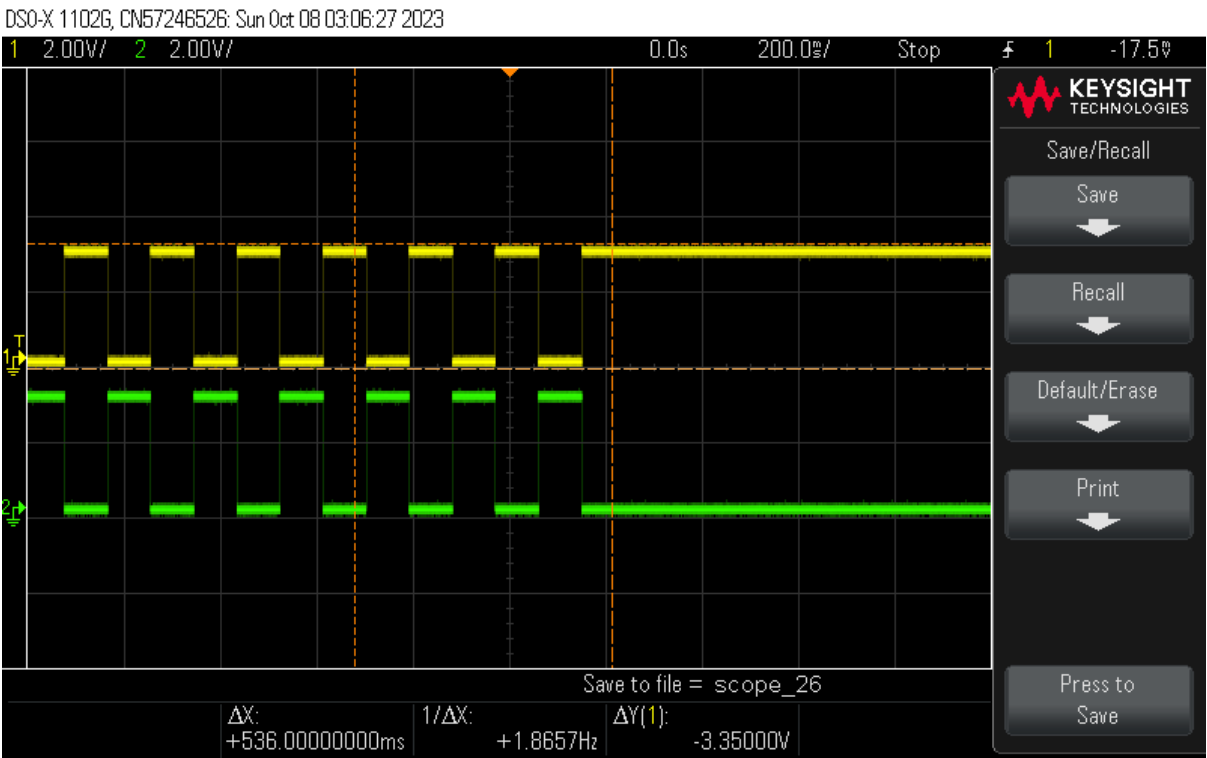


5. Oscilloscope screenshot of Toggling on-board green and blue LEDs.

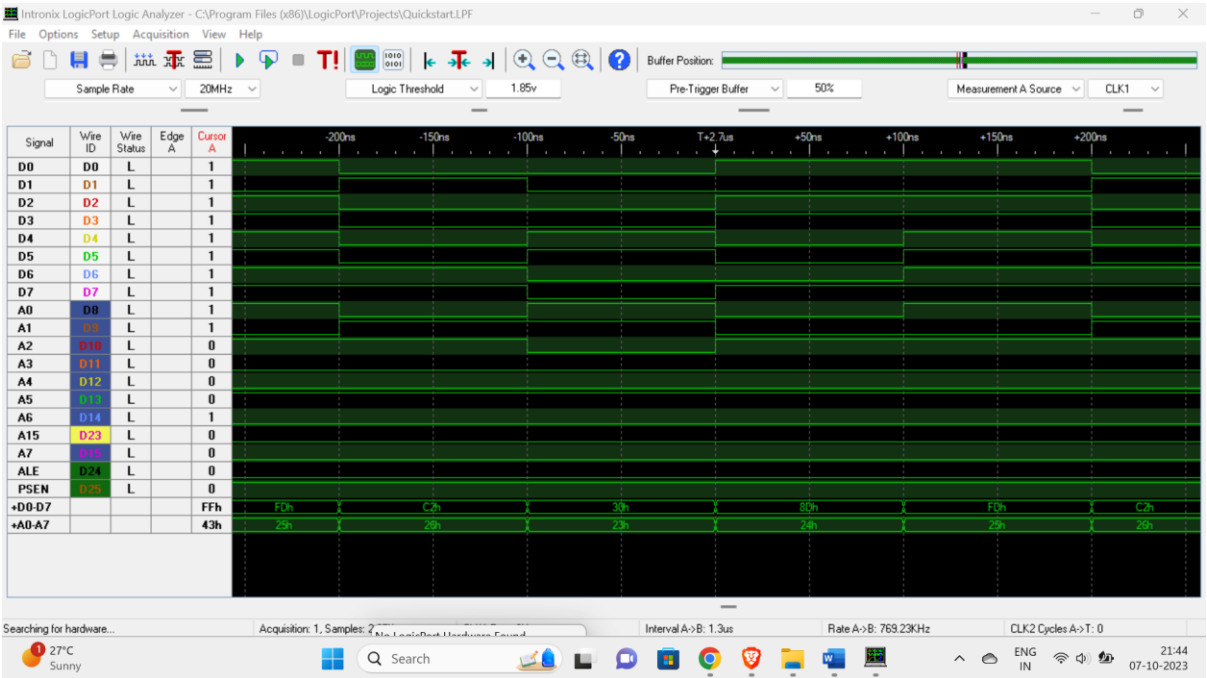
DSO-X 1102G, CN57246526: Sun Oct 08 03:05:57 2023



Oscilloscope screenshot of When the push button is pressed, toggling is stopped.



6. Logic analyzer screenshot of verifying HEX file.





Timer should run ~~for~~ till its max value 5 times  
and to obtain the remaining delay the timer  
should be loaded with  $5963D \Rightarrow E8B9H$

that is

$$TH = E8H$$

$$TL = B9H$$

18.b) Delay of 270ms for RED LED ON and OFF

$$\begin{aligned}\text{Required delay} &= 270\text{ms} & ; \text{ timer clock} &= 48\text{MHz} \\ &= 3.7\text{Hz}\end{aligned}$$

$$\text{Req freq} = \frac{\text{timer clock}}{(PSC+1) \times (ARR+1)}$$

$$(PSC+1)(ARR+1) = \frac{48 \times 10^6}{3.7} = 12972972.9\text{Hz}$$

~~Let's~~ Consider  $PSC = 0 = FFH = 256$

$$\begin{aligned}ARR+1 &= \frac{12972972.9}{256} \\ &= 50675\end{aligned}$$

$$ARR = 50674$$

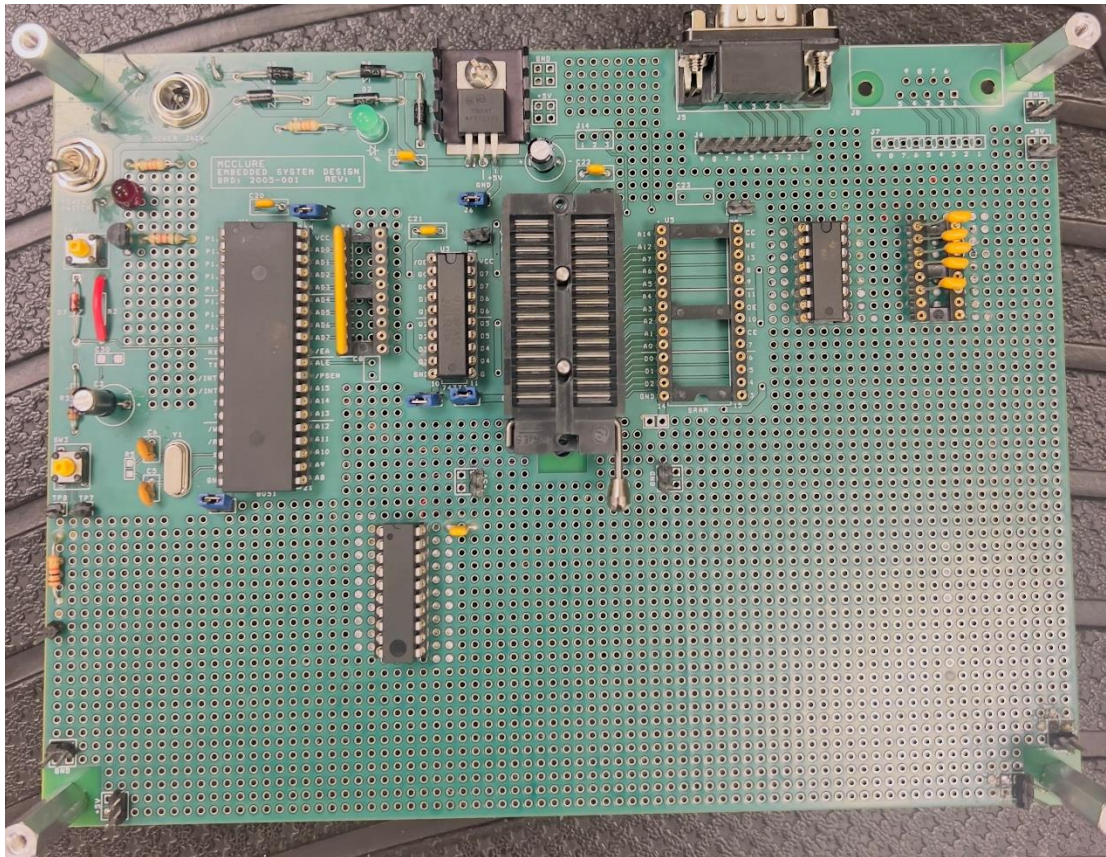
For req delay of 270ms

$$PSC = FFH$$

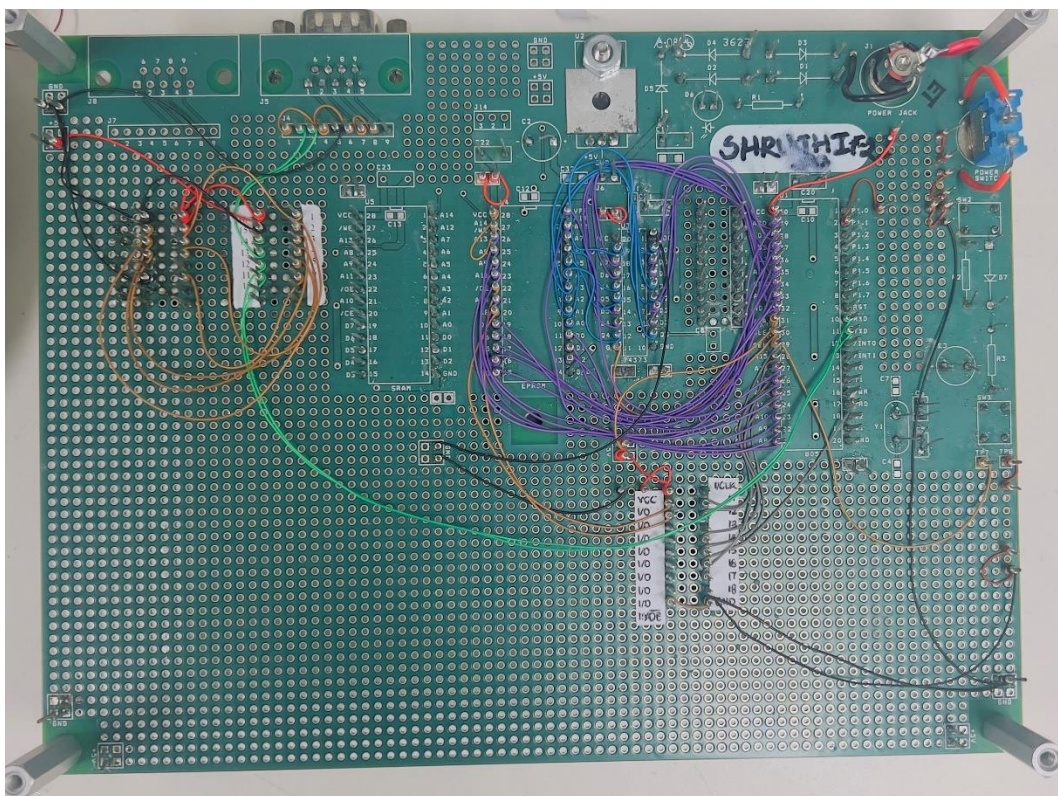
$$ARR = 50675D = C5F3H$$



## BOARD PICTURES



a. Top side of the Board



b. Bottom side of the Board